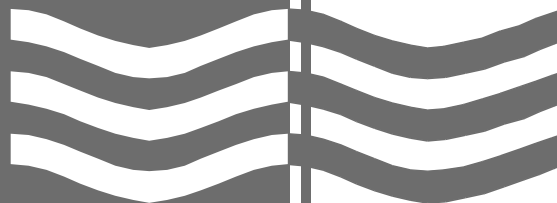


Epi Notes



North Carolina Department of Health and Human Services ♦ Division of Public Health

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Investigation of "Seizure-like" Activity in Students at N.C. High School

*Ricky Langley, MD, MPH, Medical Evaluation and Risk Assessment ,
Occupational and Environmental Epidemiology Branch*

In August 2002, a possible cluster of cases of syncopal and "seizure-like" episodes among several students at a rural high school in western North Carolina was noted by local school officials. The high school principal notified the local health department (LHD), which then began an investigation. A questionnaire was administered to students who had experienced an episode in an attempt to find a common etiology. In November, 2002, when no definite cause was found and students continued to have episodes of "seizure-like" activity, the LHD asked the Occupational and Environmental Epidemiology Branch (OEEB) of the N.C. Division of Public Health to help investigate the reported cluster.

The questionnaire developed by the LHD had been administered to 11 students who had experienced either a "seizure-like episode" or syncopal event that had been reported to the school nurse. Initially, all cases were female students in different grades of one school. Five of these students were cheerleaders. Results of the symptom questionnaire administered by the LHD showed that students had reported the following symptoms: dizziness (100%); headache (100%); numbness/tingling (80%); shortness of breath (80%); nausea (70%); altered mental status (70%); chills (60%); seizure (60%); myalgia (56%); chest pain (50%); weight loss (50%). Two students had taken over-the-counter weight loss medicine. There was no reported use of illegal drugs. Six of the students reported recent stressful life changes and eight reported adverse social consequences due to their "seizure" episodes. When asked to describe their episode (10 of 11 responded), seven described "jerking," five reported loss of consciousness, three reported dizziness or a spinning sensation, and two reported weakness. Only one student reported incontinence during or after their episode.

According to the school nurse, no evidence of significant self-inflicted injury during an episode was noted. Postictal confusion was not reported. The pattern of body movement noted by the nurse during a "seizure" did not appear typical of a seizure based on her previous experience. Later that semester a male student was involved in a motor vehicle accident thought to occur after a seizure. This increased the total number of cases under investigation to twelve.

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(Investigation of “Seizure-like” Activity, continued from page 1)

Five different physicians evaluated eleven of the twelve students. Eight students had an electroencephalogram (EEG) performed. Seven of these EEG's were performed at the time of the reported cluster, and one had been performed at two years previously. Four of the EEG's were reported to be consistent with seizure activity. Five students were diagnosed as having a seizure disorder, another one with an “atypical seizure disorder,” and one student was diagnosed with “spells and headaches.” Five of the cases had a history of anxiety or panic attacks. Two of the students were also felt to have depression. Of the eleven students seen by physicians, seven were started on anti-epileptic medications.

A physician and industrial hygienists from OEEB performed a site visit and “walk-through” of the high school. No unusual findings were observed. Water sampling results from September 2002 were reviewed. Levels of coliform bacteria, lead, copper, and trihalomethanes were not significant. The school nurse and several members of the school staff were interviewed. Medical records of the affected students were reviewed.

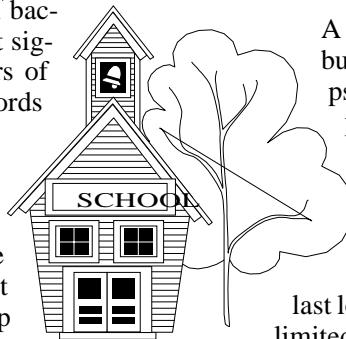
After speaking with the school nurse and students' physicians, reviewing medical records, and performing a school site walk-through, no plausible etiology could be determined. An epilepsy expert from a regional medical center was invited to help in the evaluation. This neurologist spoke with several of the students and reviewed medical records. Two students were excluded from further evaluation because of the following: one was found to have syncopal episodes due to orthostatic hypotension confirmed by tilt table testing, and the other was the male student with a typical history of petit mal epilepsy and positive changes on EEG. Of the remaining ten students, one student with a positive EEG was determined to actually have had onset of symptoms two years before the reported cluster began. Another student, who was initially reported to have had seizures and a positive EEG, underwent in-depth hospital evaluation, including video electroencephalography, and was diagnosed with “pseudoseizures.”

The frequencies of seizures among the students decreased after Christmas break and remained fairly quiescent during the spring semester. However, at the beginning of the following fall semester, some of the same students reported a recurrence of “seizures.” Another neurologist was able to perform video EEGs on three students and all were found to have pseudoseizures.

A seizure is described as an abrupt alteration in cortical electrical activity manifest clinically by a change in consciousness or by motor, sensory, or behavioral changes. There are many causes of seizures including various medical conditions, exposure to chemical agents, and traumatic brain injuries. The primary causes of seizures in adolescents are head trauma, arteriovenous malformations, alcohol or drug abuse, and idiopathic or unknown causes. Environmental causes of seizures include exposure to various chemical agents such as lead and pesti-

cides. No evidence of historical misapplication of pesticides was noted during the site visit. Limited water source testing did not suggest a problem with the water system. If the water supply had been contaminated with pesticides or other toxic agents, then far more cases would be expected to have occurred. Certain infectious agents such as cysticercosis can also cause seizures. However, this illness is primarily seen in Hispanic immigrants. None of the students reported the use of illicit drugs.

There are several conditions that can mimic true seizures. These include syncope (“fainting”), delirium tremens, confusional migraine, transient ischemic attacks, stroke, and pseudoseizures. Given the age of the students and their response to the questionnaire, most of these conditions were unlikely to have caused their symptoms. On the other hand, pseudoseizures can explain several of the cases initially diagnosed with seizures.



A pseudoseizure is an episode resembling a seizure but having a purely psychological cause. Clues to pseudoseizures include: atypical symptoms (chest pain, shortness of breath), unusual sex ratio (only one male in this cluster compared to a nearly 1:1 male-to-female ratio reported in true epilepsy) among the affected group, symptoms occurring only when the person is awake, and episodes that are always witnessed and usually last longer than expected. The postictal period is very limited or nonexistent, and the incidence of self-inflicted injury is low, as occurred in cases at this school. Pseudoseizures are characterized by non-physiologic signs such as progression of twitching from one hand to the other without spread to an ipsilateral face or leg, pelvic thrusting, asynchronous movements and voluntary eye deviation (described by the nurse in some episodes she witnessed). Pseudoseizures often occur during periods of high stress. The frequency of the prevalence of coexistent psychopathology, such as depression, panic attacks, and somatization disorder, is high. This occurred in five of the cases in this reported “cluster.” Finally, the EEG lacks the typical characteristics of epilepsy.

Of the twelve cases reported during this cluster, two appear to have been true seizures. The students' histories suggest that their symptoms actually started before the cluster began. Of the remaining ten cases, two were diagnosed with syncope (fainting), one with “spells and headaches (negative CT and MRI of the brain and normal EEG), one with an atypical seizure disorder and anxiety (negative EEG), and one student with panic attacks. One student did not provide any medical records, so the diagnosis for that student is as yet undetermined. Each of the other four cases, who were initially diagnosed as having seizures, were found to actually exhibit pseudoseizure activity based on video EEG monitoring. Psychological counseling was recommended to these students. Unfortunately, we were unable to determine factors that may have initiated the syncopal and “seizure-like” episodes among these students. It is very possible that psychological or sociologic factors were involved.

(continued on page 5)

Survey of Native American Knowledge, Attitudes, Values and Beliefs on HIV/STD, North Carolina

Prepared by Pete Moore, Senior Federal Public Health Advisor, HIV/STD Prevention and Care Branch

In an effort to better understand Native American communities and incorporate culturally appropriate information into programs serving them, the HIV/STD Prevention and Care Branch recently contracted with the North Carolina Commission for Indian Affairs to conduct a needs assessment survey among Native American communities. The goal of this project was to develop knowledge and data on the healthcare-seeking behavior, attitudes, knowledge and beliefs of American Indians in North Carolina surrounding HIV/STD issues. The Branch realized that they had little formalized data on American Indians, a population at risk for HIV/STDs. The Commission of Indian Affairs worked with a Native American community-based organization—the Native American Interfaith Ministry, Inc. (Healing Lodge)—and the University of North Carolina at Pembroke to implement the project.

The Healing Lodge was a natural group for the health department to contract with because the Branch had previously worked with them on another, more limited, project that focused on culturally competent access to care for the Native American population in Robeson County and the surrounding area. Formed in 2001, The Healing Lodge is a coalition of tribal chiefs, government associations, and ministers in Robeson County.

The current survey was completed in January of 2004. The Healing Lodge collected approximately 1,009 surveys of Native Americans from seven different tribes across North Carolina. The state health department plans to use the results of the survey to improve the cultural appropriateness of ongoing social marketing campaigns through radio, TV, billboard and bus advertisements and to plan syphilis elimination programming for Native Americans throughout the state.

Selected findings of the survey include the following:

- Only 12.6% of those surveyed claimed using condoms every time they had sex, and only 3.2% of those who admitted to having paid for sex claimed to have used condoms every time they did so.
- Thirty-seven percent of those surveyed claimed lack of transportation as a barrier to accessing health care, while 65% said inability to pay was a barrier to accessing care.
- Over 66% of those surveyed indicated that a lack of education or awareness of HIV/STD was a barrier to HIV/STD prevention in the American Indian community.
- Fifteen percent of respondents indicated that tribal religious practices prevented them from seeking HIV/STD care. ♦

Knowing Where to Go by Looking at Where We Are: Results of a Survey on the Public's Perception of Public Health Preparedness

(Part one of a two-part report)

Prepared by Bill Furney, Information Communication Specialist, Public Health Preparedness and Response



Last summer, the Office of Public Health Preparedness and Response (PHP&R) contracted the French|West|Vaughan advertising/marketing agency in Raleigh to conduct a comprehensive public perception survey during the final quarter of 2003. The survey focused on the perceptions of both North Carolina's residents and the media regarding issues related to bioterrorism and disease outbreak preparedness. The survey also included a small (non-representative) sampling of the state's Hispanic population, intended to help identify special needs or concerns, if any, for further study.

As the office responsible for educating and informing North Carolinians about the threat of bioterrorism, biological agents, disease outbreaks, and emergencies that could impact their health, PHP&R wanted to broaden its understanding of their prevailing beliefs and attitudes. Such information can be used to develop better awareness and educational materials for the public, especially during an actual disease outbreak. As the conduit through which most of such information will pass, PHP&R also wanted to better understand the media's knowledge base regarding these matters as well as what actions might be taken to facilitate the delivery of vital information to the public.

The following article is a summary of the results obtained from the public portion of the survey. Information relating to the media portion of the survey will be provided in the next EpiNotes.

Prior to conducting the quantitative public survey, French|West|Vaughan held a small focus group of eight participants, representing a diverse cross-section of the state's population, as a means of verifying pre-tested options, subjects, and general population terminology. The knowledge gained from the focus group was used to develop telephone questionnaires, making it easier for telephone respondents to indicate their choices. The questionnaire was designed to provide consideration sets to which respondents were comfortable expressing opinions.

Once the questionnaire format was completed, French|West|Vaughan partnered with East Carolina University to conduct and successfully complete 401 quantitative resident telephone surveys. During 10-minute interviews, respondents were asked a series of open and closed-ended questions. Answers provided information about respondents' previous behavior when faced with events considered to be some

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(Public's Perception of PH Preparedness , cont'd from page 3)

kind of public health emergency, their attitudes and opinions toward bioterrorism, and their expectations for the communication of information about bioterrorism or a biological agent scare.

A total of 1,406 eligible working numbers were phoned: 401 persons were successfully interviewed, 752 refused interviews, 232 of the numbers were busy/no answer, and 21 scheduled interviews remained, allowing for a completed questionnaire. At a confidence level of 95 percent, a sample of 400 of North Carolina's 8.2 million residents yields a confidence interval of five. Given the purpose of the recommended research, the reliability of the data is considered adequate. (See equation below for determination of sample size at 95 percent confidence and five-point confidence interval. N is the population size, n is the sample size, and e is the level of precision or confidence interval.)

$$n = \frac{N}{1 + N(e)^2}$$

The sample was drawn randomly from the state's households with telephones. As a result of the random selection process, the sample is representative of the state's adult population from the perspectives of age, education, income, and ethnicity. However, every survey method has inherent sample error. Some groups of the population are less likely to participate in any type of survey research and female household heads are more likely to answer the telephone than male household heads. Quota sampling was used in order to achieve equal participation by both men and women.

Regarding ethnicity, 82 percent of the respondents reported themselves to be white/Caucasian, 13.8 percent black/African-American, less than 1 percent Asian, and about 1 percent Hispanic/Latino, Native American, and Other. One third (33.7 percent) of the respondents reported their household family income was not above \$30,000, 44.8 percent not above \$60,000, and 54.4 percent not above \$90,000.

Although the survey included more than 25 questions and collected much more information and insights than can be reported in EpiNotes, the study provided information in a number of areas that will be helpful in developing preparedness plans. According to the survey, North Carolina residents are not very concerned about "public health emergencies." When asked to name public health emergencies, they thought first of naturally occurring health concerns such as communicable diseases or acts of nature. When asked specifically about chemical or biological terrorist attacks, however, they were very concerned. North Carolinians need a better understanding of potential bioterrorist threats and appropriate responses should an attack occur.

Regarding public health emergencies as understood by respondents, those surveyed believe that the state is moderately prepared to handle such situations. Most respondents saw the state as somewhat prepared for most public health emergencies but not well prepared to deal with chemical or biological terrorist emergencies.

The health threat issues that resonated most with the group were SARS and West Nile virus, probably attributable to the recent outbreaks and media coverage. Respondents had sought information from a variety of sources and changed their lives to some degree in relation to West Nile virus (use of mosquito repellent, elimination of standing water, staying indoors) but did not believe there was anything reasonable they could do to protect themselves from SARS. SARS provides more of a model of an emergency situation, while West Nile is more of an endemic, ongoing, non-emergency threat.

Respondents say they have sought in the past, and would seek in the future, information about a public health emergency from local television and radio news programming.

With the exception of leaving their children at a remote location during an emergency, respondents said that they would be willing to respond to and abide by requests from public health and other governmental agencies.

In general, residents indicated that they have a high regard for state agencies, though they cannot necessarily name or distinguish between them. Residents also have a high regard for the Centers for Disease Control and Prevention and are inclined to trust the police, the army, and doctors.

Results from the small Hispanic population spot sampling indicated four areas of interest. It appears that the possibility of attack from bioterrorism does not cast as long a shadow on the Spanish-speaking community as it does on the English-speaking community. As a result, Hispanics may not be as proactive in seeking bioterrorism information as their English-speaking counterparts.

It is probable that many Hispanics would look to Spanish-language media (television, radio, newspapers) during public health emergencies, but the importance of "word-of-mouth" dissemination of information should not be underplayed. While they generally trust the information coming from the Spanish-speaking media, Hispanics often rely on family members and other members of their community for information during emergencies. These community contacts are most likely to be accessed via Hispanic churches and community centers. Identifying strong community leaders and developing grassroots information dissemination would be beneficial.

The type of information most effective in preparing the Hispanic community for a bioterrorist attack or other public health emergencies would be a clear, concise description of symptoms, where to go for treatment, and how to reduce risk. Stick to the facts and make the message as simple as possible.

Conclusions:

The study provides information in a number of areas that will be helpful in developing preparedness messages. What is clear is that North Carolina residents do not yet identify chemical or biological attacks as public health emergencies. Because of this, future PHP&R educational and informational efforts will focus on better defining biological, chemical and radiological

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Hepatitis C Program

*Prepared by Susan Thompson, RN, Hepatitis C Coordinator
HIV/STD Prevention and Care*

Hepatitis C is an emerging public health problem. Hepatitis C affects almost four million Americans—with almost 30,000 new cases diagnosed every year and is four times more prevalent than the AIDS virus and is the most common reason for liver transplants in the United States. Yet, because it produces few, if any, symptoms in its acute stage, most people don't know they have it and continue to spread it. Co-infection with hepatitis C, HIV, hepatitis B, and TB is also a growing concern. Deaths from chronic hepatitis C among patients with HIV are expected to increase as advances with antiretroviral therapy extend the life spans of these patients. Recognizing this emerging threat, the CDC has earmarked funds to hire hepatitis C coordinators in all 50 states. The primary objective of the coordinators is to integrate HCV prevention and control activities into existing public health programs.

Susan Thompson, RN, MPH, was hired in August 2003, as the North Carolina hepatitis C coordinator. She is based in the Field Development Unit of the HIV/STD Prevention and Care Branch. Since August, she has been actively working to assess the extent of hepatitis activities currently being conducted in the state, to investigate additional funding sources in order to develop/enhance hepatitis C services, and to establish relationships and develop partnerships with jail health staff, HIV/STD clinics, substance abuse treatment centers, local health departments, private medical providers, consumers, and community-based organizations, as well as with hepatitis C coordinators in other states.

In April of 2003, the HIV/STD Prevention and Care Branch partnered with the state Immunization Branch to begin a vaccination program for those at risk of contracting viral hepatitis. Currently, there are over 46 sites across the state offering Twinrix vaccine (a combination vaccine for Hepatitis A and Hepatitis B) to persons with the following risk factors: men who have sex with men, people with multiple sex partners, people who are or have been incarcerated, IV drug users, and people who infected with hepatitis C, HIV or who have an STD. Since her arrival, Ms. Thompson has been actively involved in the Twinrix program, and in identifying funds to support HCV program activities. She has also developed a survey to assess the current level of hepatitis services in local health departments and has created a hepatitis C information packet which will be distributed to stakeholders for use as an educational/resource tool for HCV + patients and those at risk for HCV.

Future efforts will focus on the integration of hepatitis C activities/services into the existing HIV/STD infrastructure, the creation of a hepatitis C task force to guide program activities and collaborate on a strategic plan, and the development and implementation of a state-wide Hepatitis Education and Awareness campaign. ♦

(Investigation of “Seizure-like” Activity, cont'd from page 4)

The neurologist informed the school staff that the students who were evaluated by video EEG had a diagnosis which was psychiatric in nature, not true seizures. The school staff was also instructed on how they should respond if a student had another episode at school so as to avoid secondary gain. In order to explain pseudoseizures and to counsel the affected students, the neurologist conducted group interviews with the students who had video EEG performed and with their parents.

Because the diagnosis of epilepsy may have numerous implication, such as potential restrictions of an individual's employment or driving license privileges, it is important that a neurologist with expertise in epilepsy evaluate the patient and establish a diagnosis. This is important to avoid unnecessary use of anti-epileptic medications and disruption of school activities, and to allow earlier counseling of individual patients and school officials. This requires vigilance on the part of school officials and early notification of local physicians and public health officials if an unusual cluster of seizure-like activity occurs.

References

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2. Mkize D, Ndabeni R. Mass hysteria with pseudoseizures at a South African high school. *S Afr Med J.* 2002;697-699. ♦

(Public's Perception of PH Preparedness, cont'd from page 4)

attacks as public health emergencies. Other aspects include the following:

- PHP&R is preparing an educational tabloid-type publication to be inserted into newspapers across the state and distributed to the public on the third anniversary of the 9/11 attacks. The insert is being designed to increase the level of credibility associated with the state's ability to handle an emergency and instill a great sense of confidence that state public health agencies are prepared to deal with public health emergencies and bioterrorism attacks.
- Respondents have in the past, and will in the future, seek information about a public health emergency from local television and radio news programming. For this reason DHHS and PHP&R are working to strengthen their lines of communication with state television and radio news stations. In the event of an emergency, DHHS will provide information to outlets as quickly, completely, and accurately as possible.
- With the exception of leaving their children at a remote location during an emergency, respondents were willing to respond to and abide by requests from public health and other governmental agencies. PHP&R continues to study this issue, focusing on preparing plans and guidelines that will keep parents and children as safe as possible during an emergency if parents insist on picking children up from school. ♦

Next EpiNotes: Part 2, The Media

Chemical Terrorism Preparedness at the N.C. State Laboratory of Public Health

Prepared by Lou F. Turner, DrPH, Director, North Carolina State Laboratory of Public Health and Leslie A. Wolf, PhD Assistant Laboratory Director

The North Carolina State Laboratory of Public Health (NCSLPH) has been preparing for biological terrorism events since 1999, and has been responding to hoaxes and true crises such as the October 2001 anthrax mailings. Preparing for and responding to chemical terrorism events, however, has been a new program under development since August 2003. This new program allows NCSLPH to integrate the expertise of current staff in the areas of clinical chemistry (blood lead testing), bioterrorism preparedness and response (LRN), and environmental sciences (inorganic and organic chemistries).

In response to the Centers for Disease Control and Prevention (CDC) Preparedness and Response for Bioterrorism Grant, the NCSLPH applied for funding under "Focus Area D: Laboratory Capacity— Chemical Agents." The purpose of this focus area is to develop standardized nationwide laboratory capacity that provides rapid and effective analysis of clinical specimens for selected chemical agents likely to be used in terrorism. The NCSLPH elected to become a Level-Two Chemical Terrorism Preparedness Laboratory. This designation allows the NCSLPH to assist with the proper collection and shipment of human samples for testing and to actually test for the metabolites of chemicals that may be used in a terrorist event. Utilizing CDC guidance and direction, SLPH has established four new positions to build the chemical terrorism program in order to prepare for and to respond to such an event. Recruitment of a chemistry supervisor and chemist-level positions is under way. Due to the nature of the chemical terrorism laboratory program, the new staff and protocols must meet a level of competence and quality assurance for both the Clinical Laboratory Improvement Amendments of 1988 (CLIA) and the Environmental Protection Agency (EPA).

Three new state-of-the-art instruments have also been purchased and installed, and training of new staff members is planned for early summer 2004 at CDC. Several instruments, a gas chromatograph-mass spectrometer (GC-MS), an automated prepsation, and an inductively coupled plasma-mass spectrometer (ICP-MS), will be designated for detection of industrial chemicals, heavy metals, lewisites (arsenic containing compounds) and cyanide, and/or their metabolites, in blood and urine samples from humans who are exposed during a chemical terrorism event. These laboratory measurements will help guide emergency medical care, public health management of a chemical terrorism incident, and follow-up of a chemical terrorism incident event by identifying the chemical agent(s) used, and determining who was exposed and how much exposure each person received. The NCSLPH looks forward to cooperating and collaborating with other agencies in the state's efforts to prepare for and respond to a chemical terrorism event. For further information about this new program, please contact Dr. Lou Turner at 919-733-7834. ♦

The North Carolina Adult Blood Lead Epidemiology and Surveillance Program (ABLES)

Prepared by Don Chaney, Technical Trainer, Health Hazards Control Unit, Occupational & Environmental Epidemiology



Elevated Adult Blood Lead Levels - The Problem

Lead has been recognized as a health hazard since ancient times. Ninety to ninety-five percent of adults with elevated blood lead levels are exposed occupationally. This number is known to be an under estimate because many lead-exposed adults do not have routine blood lead level testing. Adults exposed to lead can experience anemia, nervous system dysfunction, kidney problems, hypertension, decreased fertility, and increased miscarriages. Workers can bring lead home from their workplace, and unknowingly expose their families. It is estimated that two to three percent of children with blood lead levels of 10 micrograms per deciliter (mcg/dL) or greater may have been exposed by lead brought home from work.

What is ABLES?

The ABLES program is a state-based surveillance program of reported adult blood lead levels. It is intended to both identify and prevent cases of elevated blood lead levels in adults. ABLES was started in 1987 by the Centers for Disease Control and Prevention (CDC), National Institute for Occupational Safety and Health (NIOSH) with the participation of four states, and had grown to involve about 35 states by 2003. The CDC, NIOSH ABLES program provides funding and technical assistance to participating states. The public health objective of the ABLES program (Objective 20.7 in Healthy People 2010) is to "Reduce the number of adults who have blood lead concentrations of 25 (mcg/dL) or greater of whole blood." The Occupational Safety and Health Administration (OSHA) regulations allow workers to return to work when their blood lead levels are 40 mcg/dL or below. State ABLES programs collect blood lead level data from local health departments, private health care providers, and from both private and state reporting laboratories.

N.C. ABLES

ABLES states are required to have a mandatory state requirement that laboratories report blood lead level results to the state health department or designee. In North Carolina, the reporting requirements are set forth in N.C. General Statute §130A-455 through 460, and North Carolina Administrative Code 10A NCAC 41C .0700 Occupational Health Surveillance. The reporting requirements address reportable diseases, illness, and injuries that include asbestosis, silicosis, serious farm injuries, and elevated blood lead levels for adults age 18 years and above. Adult blood lead reports are received by the Occupational & Environmental Epidemiology Branch in a variety of formats, including electronic reporting, surveillance report forms and computer disk mailings.

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(N.C. ABLES Program continued from page 6)

Elevated blood lead levels in children are reported to a separate program, the N.C. Department of Environment and Natural Resources (DENR) Childhood Lead Poisoning Prevention Program (CLPP). The N.C. ABLES and CLPP programs work cooperatively, as needed, to share information and address the prevention of occupationally related take-home lead issues.

The N.C. ABLES program has been receiving blood lead reports since 1994; the database now contains over 15,900 blood lead data entries. In 2003, the N.C. ABLES program processed approximately 6,440 blood lead reports and identified 221 individuals with elevated blood lead levels.

The N.C. ABLES program uses reported information for many purposes including data analysis and reporting to NIOSH; conducting consultation and follow-up with physicians, workers, and employers; performing on-site evaluations of work sites; making referrals to cooperating agencies; identifying new exposures; and targeting educational and other interventions.

Referrals of ABLES data between the N.C. ABLES program and the N.C. Department of Labor (N.C. DOL), Occupational Safety and Health Administration has proven to be a useful mechanism for the N.C. DOL lead emphasis programs. Of the estimated 131 lead-related site visits or inspections conducted by N.C. DOL this past year (2003), approximately 100 of these visits were initiated as a direct result of the ABLES data. This has helped in the identification of high-risk industries and occupations while improving existing safety and health programs required of employers, most recently including fire-arm range operations, battery manufacturing plants, foundries, and bridge-related construction and maintenance work throughout the state of North Carolina.

Nationwide data from the state ABLES programs are published in CDC's Morbidity and Mortality Weekly Report (MMWR) and elsewhere. The reports published in the MMWR may be viewed at the following web site: <http://www.cdc.gov/mmwr/> by entering a search for "Adult Blood Lead Epidemiology and Surveillance." ♦

Multiple Locus Variable Number Tandem Repeat Assay: A New Molecular Subtyping Method for Foodborne Outbreaks

*Prepared by Kate Volpe, Medical Laboratory Specialist
North Carolina State Laboratory of Public Health*

Listeria monocytogenes is a gram-positive, facultative anaerobic rod-shaped bacterium that can tolerate high salt concentration and low pH and that can multiply at refrigerator temperatures. It is the causative agent of an illness known as listeriosis, and is most commonly acquired through consumption of contaminated, refrigerated, ready-to-eat foods such as soft cheeses and deli meats. Those at risk of listeriosis include the immunocompromised, the elderly, pregnant women and neonates. A number of multi-state outbreaks have occurred in

recent years when ready-to-eat deli meats and other ready-to-eat meat or cheese products contaminated with *L. monocytogenes* have been widely distributed. Given the severity of *L. monocytogenes* infections and potentially tragic outcomes (stillbirths, spontaneous abortions or infected neonates), improving the detection of outbreaks and the discriminatory power of molecular subtyping methods would benefit the national food safety initiative. Since listeriosis is a reportable illness in North Carolina, the North Carolina State Laboratory of Public Health (NCSLPH) requests that all clinical microbiology laboratories in our state submit *L. monocytogenes* isolates for confirmation and molecular subtyping.

In order to follow outbreaks in North Carolina and nationwide, NCSLPH participates in PulseNet, the CDC-based national molecular subtyping network for foodborne bacterial pathogens. Currently, subtype-based surveillance for foodborne pathogens in PulseNet laboratories is based on the comparison of DNA fragment patterns generated by macro-restriction of total genomic DNA and their separation by pulsed-field gel electrophoresis (PFGE). While this technique is currently the gold standard, it is labor-intensive, and inter-laboratory comparisons require strict adherence to standardized experimental conditions in order to obtain comparable results. In October 2002, NCSLPH was awarded an applied research grant from the CDC via the Association of Public Health Laboratories to develop a DNA sequencing-based subtyping scheme. Public health laboratories in Minnesota and Massachusetts were selected to initiate similar research projects for *Salmonella* serotypes Enteritidis and Typhimurium and *E. coli* O157:H7, respectively, in the fall of 2001.

Our research is aimed at developing a DNA sequence-based molecular subtyping system for *L. monocytogenes* that can be implemented in PulseNet laboratories to replace or complement existing PFGE protocols. The subtyping method involves the identification and characterization of variable number tandem repeats (VNTR) within the bacterial genome. VNTR contain nucleotide patterns from 2 base pairs (bp) to over 200 bp repeated in tandem arrays. As the bacteria replicate DNA, mutations can occur frequently at these locations that may result in a change in the number of tandem repeats. Our goal is to identify between five and seven VNTR loci that will provide subtype discrimination greater than or equal to PFGE. Each of these VNTR loci will be amplified and labeled with fluorescent dyes using PCR methods. The amplified dye labeled PCR products and DNA marker (or size ladder) are sized using capillary gel electrophoresis. NCSLPH employs the Beckman Coulter CEQ 8000 fragment analysis program to determine the PCR fragment size for each VNTR loci in each *L. monocytogenes* isolate. The fragment size is used subsequently to determine the number of repeats. We have identified and are currently testing eight loci in the multiple-locus VNTR assay (MLVA). All available *L. monocytogenes* isolates will be analyzed using all eight loci. The presence and size of each tandem repeat will define the patterns that are used for classification by subtype. Isolates that have indistinguishable patterns will be considered most closely related. The MLVA method ultimately will be compared with PFGE, ribotyping, serotyping and available epidemiological informa-

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Human Monkeypox, African Rodents, and Prairie Dogs

Prepared by C. Gregory Smith, MD, MPH, Medical Epidemiologist, General Communicable Disease Control Branch

Historical Perspective

Until May 2003, human monkeypox (MPX) was an obscure sporadic zoonosis confined to the equatorial rain forests of Africa. The disease, which clinically resembles smallpox (SPX), is caused by an orthopoxvirus genetically similar to *Variola major* and *V. minor*, the etiologic agents of human smallpox. The natural history of MPX has not been well studied but evidence suggests that rodents serve as the primary viral reservoir. Monkeys and other primates, including humans, are susceptible to the disease, but routes of exposure and transmission have not been clearly delineated. For Africans, increased trade in bushmeat is one possible emerging, but as yet unproven, risk factor for MPX in enzootic areas.

The first human cases of MPX were identified in the 1950s. Following the eradication of SPX in sub-Saharan Africa, about 400 cases of MPX were reported from the tropical rain-forested countries of West and Central Africa between 1970 and 1994. Of these, 95% were reported from Zaire during a period of intense surveillance from 1982-1986. Epidemiologic and laboratory studies conducted during that period provide the foundation of our knowledge about MPX in the natural setting. Cases tend to occur singly or in small clusters, with the majority of human infections attributable to contact with infected animals. Compared to SPX, MPX is less virulent and less transmissible to humans. The incubation period for MPX is about 12 days (range 7-17 days). Clinically, MPX resembles the ordinary or modified forms of SPX. Symptoms include fever, headache, muscle aches, backache, swollen lymph nodes, a general feeling of discomfort and exhaustion. In contrast to SPX, lymphadenopathy tends to be more prominent in MPX and it occurs early in the disease. The routes/mechanisms of person-to-person transmission for MPX also are similar to those of smallpox, but the rate/risk of secondary transmission for MPX appears to be significantly lower, in the range of 8%. Illness due to MPX lasts from 2 to 4 weeks. The case fatality rate of MPX is lower compared to SPX. Among unvaccinated populations in West Africa, the case fatality rate for MPX varies between 1% to 10%; it may be higher in young children.

Due to the genetic similarities between the SPX and MPX orthopoxviruses, smallpox vaccination with *Vaccinia* virus provides protection against both diseases. It has been suggested that the primary reason MPX has been an uncommon disease in equatorial Africa is due to residual immunity from SPX vaccination in the 1950s and 60s. Although residual humoral immunity from SPX vaccination is likely a protective factor in some areas, recent studies indicate that human MPX is uncommon even in enzootic areas where the rate of historical smallpox vaccination is known to be low.

Importation of Monkeypox to the U.S.

As recently as 2000, one public health reference (APHA, Chin) put human MPX in the following perspective: "There is no evidence that monkeypox will become a public health threat outside of enzootic areas." That heretofore accurate assessment was upended by a shipment of 762 exotic rodents destined for the pet trade (50 Gambian giant rats, 510 dormice, 53 rope squirrels, 47 tree squirrels, 100 striped mice, and 2 brushtail porcupines) that were imported to the U.S. from Accra, Ghana on April 9, 2003. Here is what we now know.

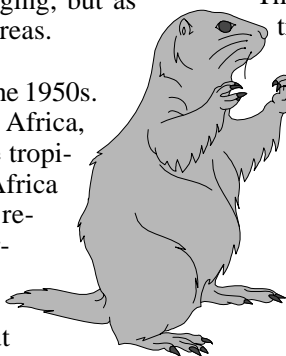
Following their arrival in Texas, the African rodents were parceled out to animal distributors in Texas, New Jersey and Iowa. A group of Gambian giant rats and dormice from the Iowa distributor was then shipped to an Illinois distributor who happened to have 200 prairie dogs at his facility. It appears the prairie dogs at the Illinois facility were subsequently infected through close contact with the Gambian giant rats and dormice.

The infected prairie dogs then served as disease vectors, transmitting MPX to humans who acquired them as pets or otherwise handled them. Symptoms and signs of MPX present in the infected rodents included cough, the presence of pus in the eyes or nose, swollen lymph nodes in the arms and legs, and bumpy or blister-like rash. Subsequent testing of some of the rodents from the Ghana shipment by the CDC confirmed MPX infection in Gambian giant rats, dormice, and rope squirrels. Of the 762 animals in the shipment, as of July 2003, about 465 were known to be dead, 121 alive, and about 178 (mostly dormice) lost to follow-up. Although latent viral infection in animals is not known to occur, it has not been completely ruled out either. Images of dormice and the other implicated rodent species may be found under the CDC monkeypox link in the reference list.

Human Illness, Epidemiologic Investigation, and Use of Smallpox Vaccine

The first human cases of domestic MPX were identified in Illinois and Wisconsin in mid-and late May 2003. Of 30 cases with detailed clinical information, the majority (73%) experienced a febrile illness preceded or accompanied by the onset of a papular rash; other prominent findings included respiratory symptoms (64%), lymphadenopathy (14%), and sore throat (33%). Rash distribution included the head, trunk and extremities, with initial and satellite lesions occurring on the palms, soles and extremities of many patients; in some the rash was generalized. In most, the rash progressed through stages of vesiculation, pustulation, umbilication and encrustation. Early lesions ulcerated in some patients. Fourteen patients were hospitalized, including a child with encephalitis.

As of July 8, 2003, 71 cases of MPX had been reported to the CDC by the following states: Wisconsin (39), Indiana (16), Illinois (12), Missouri (2), Kansas (1) and Ohio (1). Of these, 35 were laboratory confirmed by CDC and 36 were classified as suspect or probable cases under investigation by local and state health departments. The most recent case definition, criteria for laboratory confirmation, and evolution of the outbreak
(continued on page 9)



investigation may be found by accessing the CDC monkeypox link in the reference list.

Smallpox vaccine is recommended for those investigating monkeypox outbreaks and those either caring for, or having close or intimate contact with, infected people or animals. According to the CDC, vaccine may be given up to 14 days after exposure to monkeypox. Additional information on treatment and vaccination may be found in the CDC monkeypox link in the reference list.

Impact of the Outbreak on North Carolina

Fortunately, none of the imported African rodents or prairie dogs infected at the Illinois facility were transported to North Carolina. Nevertheless, North Carolina was subject to the June 11, 2003 Joint CDC/FDA Order banning the interstate and intrastate movement of prairie dogs except for the purpose of evaluation/treatment by a veterinarian. This has caused problems for pet stores, individuals, and others who have been unable to legally sell, transport, or otherwise move them. Despite requests by governmental agencies that people not release their captive prairie dogs into the wild, we know of one, and possibly two instances, where that has occurred in North Carolina. Such action could result in the establishment of feral prairie dog colonies. Additionally, release of any prairie dogs associated with the imported African rodents into their natural Midwestern habitats could introduce MPX virus into native U.S. prairie dog (or other wild rodent) populations.

On November 4, 2003, FDA and CDC issued an interim final rule (effective November 5, 2003) replacing the June 11, 2003 Joint Order. It prohibits, until further notice, the capture, offer to capture, transport, sale, barter, exchange, distribution, offer to distribute, or release into the environment of prairie dogs and African rodents. The rule applies to both alive and dead animals. The only exceptions are movement to a veterinarian or animal control officer for the purpose of care, quarantine or destruction. Persons, pet stores/dealers or institutions needing to move animals for other reasons must apply to FDA for an exemption. The rule is not intended to pre-empt more restrictive state or local regulations, but those regulations cannot permit something the rule prohibits. Further details on the interim final rule and procedures for applying for an exemption may be found on the CDC/FDA link listed in the reference section.

The best evidence to date suggests that the infectivity and incubation period of MPX is three months or less. If no more cases of animal or human MPX occur six months from July 20, 2003 (the date of last animal death), and if ongoing vector-related studies at CDC find no reason to continue the ban on domestic movement, the restrictions may be lifted in 2004. However, the ban on the importation (and exportation from the U.S.) of alive or dead rodents endemic to Africa continues indefinitely. Recently, U.S. Fish and Wildlife Agency officers confiscated a shipment of smoked West African rodents in Atlanta purportedly destined for Charlotte, N.C. for distribution to local West African food markets. It is important to understand that only those products that have undergone heat or chemical treatment to destroy infectious agents and fully

taxidermied specimens constitute the only exceptions to the import ban. However, following appropriate application, import and export exemptions for covered rodents may be issued for legitimate scientific, educational, or exhibition purposes.

Emerging Public Health Concerns

The recent MPX outbreak in prairie dogs and humans has demonstrated the great costs associated with unregulated importation of exotic animals and translocation of native wildlife species for the pet trade. We know that prairie dogs are vectors for tularemia, plague (via infected fleas), MPX, and possibly salmonellosis. Although prairie dogs were innocent bystanders in the MPX outbreak, the practice of vacuuming these animals out of their burrows and selling them into the pet trade nationally and internationally now deserves close scrutiny. Although some claim prairie dogs make good pets, knowledgeable veterinarians testify that males especially become aggressive at sexual maturity, biting their owners and others who handle them. Each bite to a human that is reported must be followed up by the local animal control agency. Investigation often requires consultation with public health veterinarians and the state's public health laboratory, especially when rabies must be ruled out. Additionally, a single human case of prairie dog-associated tularemia or plague diagnosed in North Carolina would trigger an epidemiologic investigation and notification of appropriate state and federal agencies.

To begin addressing the public health issues surrounding the trade in exotic and native wildlife, in June 2003, the Council of State and Territorial Epidemiologists (CSTE) Infectious Diseases Committee adopted a resolution titled: *Developing Importation and Exportation Restrictions on Exotic and Native Wildlife with Potential Adverse Impact on Public Health*. Additionally, on July 17, 2003 the CDC provided testimony (CDC's Role in Zoonotic Disease Outbreaks) to the Committee on Environment and Public Works. New regulatory measures may be enacted in the near future to minimize emerging public health risks associated with the international trade in wildlife.♦

References and further readings:

1. Control of Communicable Diseases Manual. James Chin, MD, MPH, Editor, 17th Edition 2000, American Public Health Association, Washington D.C. pp 458-459.
2. CDC: Information on monkeypox: <http://www.cdc.gov/ncidod/monkeypox/index.htm>
3. CDC/FDA: Joint CDC/FDA Interim Final Rule <http://www.fda.gov/ohrms/dockets/98cfr/03-27557.htm>

(Multiple Locus Variable Number Tandem Repeat Assay, cont'd from page 7)

tion to determine if the methodology results in a useful molecular subtyping tool. By utilizing a new method based on PCR and VNTR analysis, the current challenges of automation, protocol standardization and data portability during multi-state outbreak investigations should be minimized significantly. Faster, better results translate into better public health responses to outbreaks or food contamination events.♦

Reported Communicable Disease Cases, N.C., January-March 2004 (by date of report)*

Disease	Year-to-Date (First Quarter)			1 st Quarter 2004	Comments / Notes
	2004	2003	Mean (99-2003)		
Campylobacter	115	146	104	115	
Chlamydia, laboratory reports	6852	6024	5369	6852	
Cryptosporidiosis	25	9	7	25	Note 1 & 2
Dengue	1	2	1	1	
E. coli, Shiga toxin-producing	3	6	8	3	Note 3 & 9
Ehrlichiosis, Monocytic	3	5	2	3	
Foodborne, C. perfringens	2	2	9	2	
Foodborne, other	16	3	2	16	
Foodborne, staphylococcal	3	1	3	3	
Gonorrhea	3914	3469	4139	3914	
Haemophilus influenzae	12	5	11	12	
Hepatitis A	16	22	48	16	
Hepatitis B, acute	44	39	54	44	
Hepatitis B, chronic	136	203	166	136	
Hepatitis C, acute	3	3	7	3	
HIV/AIDS	465	573	416	465	Note 5
Legionellosis	7	7	4	7	
Listeriosis	4	5	-	4	Note 8
Lyme disease	30	12	9	30	
Malaria	4	5	4	4	
Meningococcal disease	10	6	17	10	
Meningitis, pneumococcal	11	7	18	11	
Mumps	1	2	2	1	
Rabies, animal	148	178	133	148	
Rocky Mountain Spotted Fever	66	34	20	66	
Salmonellosis	192	260	223	192	
Shigellosis	111	205	91	111	
Strepto. A, invasive	34	31	31	34	
Syphilis, total	116	115	230	116	Note 6
Tuberculosis	38	37	52	38	
Toxic Shock Syndrome (TSS)	1	0	1	1	
TSS, Streptococcal	1	0	0	1	
Typhoid, Acute	2	1	0	2	
Vanco. Resistant Enterococci	182	126	121	182	
Vibrio, other	2	3	2	2	
Whooping cough	26	45	26	26	

*Preliminary data, as of 4/12/2004. Quarters are defined as 13-week periods. Only diseases with cases reported in the year 2004 are listed in the table. Notes: 1. Not reportable in this entire time period; 2. Reportable since 8/1/1998; 3. E. coli O157:H7 became reportable 10/1/1994; 4. Became reportable as "Hepatitis C, acute" rather than the previous "Hepatitis, non A-non B," and as "arboviral encephalitis" (coded by type) rather than "Encephalitis," both changes 8/1/1998; 5. Earliest report with HIV infection or AIDS diagnosis; 6. Primary, secondary and early latent syphilis; 7. Reportable since 7/1/1997; 8. Reportable since 7/2001; 9. Reportable since 2/15/2003; and E. coli, Shiga toxin-producing replaces E. coli O157:H7; 10. Coded as such since 2002.

2003 Perinatal Hepatitis B Prevention Program Summary Report, 2001 Birth Cohort

*Prepared by Patricia Poole, R.N., Hepatitis B Coordinator
Immunization Branch, Women's & Children's Section*

When children under five years of age become infected with hepatitis B virus (HBV), they are at greater risk of developing life-long complications. Without prophylaxis, up to 85 percent of infants born to hepatitis B surface antigen (HBsAg)-positive women will become infected with HBV and will have a 90 percent chance of remaining infected for life. These chronically infected infants have a 25 percent chance of death due to liver disease as adults. However, with prophylaxis, 90 percent of these infections can be prevented.

Each year, North Carolina local health departments track cases of HBsAg-positive pregnant women, their sexual and household contacts, and the infants born to infected women. Infant tracking is conducted to ensure proper immunoprophylaxis, and completion of the hepatitis B vaccination series at age six months. Post-vaccination testing for immune response (anti-HBs) and disease onset is recommended three to nine months after completion of the vaccination series.

Of the reported 173 infants born in 2001 to HBsAg-positive mothers, all received the first dose of hepatitis B vaccine prior to hospital discharge, but six (3.5 percent) did not receive hepatitis B immune globulin (HBIG). Missed HBIG doses resulted from failure to properly identify the mother's HBsAg status because of errors in interpretation or transcription of maternal hepatitis B screening test results, or failure to communicate these test results to/within the hospital. Fifty-nine percent of infants completed the three-dose series by eight months of age. Data from 2001 indicate 53 percent of infants received post-vaccination serologic testing.

Even with complete prophylaxis, three infants born in 2001 tested positive for HBsAg. Two of these infants were not tracked but were found retrospectively by health department staff. Of the state's births to HBsAg-positive women in 2001, as many as 147 infants could have been infected with HBV had they not been vaccinated.

Although extensive efforts are made to identify and vaccinate infants born to HBsAg-positive women, many infants remain at risk. National estimates from Centers for Disease Control and Prevention reveal approximately five percent of prophylaxed infants born to HBsAg-positive mothers do not develop immunity with the first vaccination series and an additional six percent will become infected. Two strategies, if implemented, would provide "safety nets" to protect unidentified high-risk infants:

- 1) documentation of the *original* (not interpretation of) maternal HBsAg test results in all maternal/infant medical records to ensure identification of HBsAg-positive (i.e., infected) women; and
- 2) offering the first dose of hepatitis B vaccine to all newborns prior to hospital discharge (as recommended by

the Advisory Committee on Immunization Practices, American Academy of Pediatrics, American Academy of Pediatrics, 715-6777.

North Carolina's perinatal hepatitis B prevention efforts are improving. However, barriers still exist to assure the completion of all preventive measures in the infants born to HBsAg-positive women. Hospitals, health departments and providers must work together to report and maintain contact with these high-risk mothers and infants to assure proper identification, prophylaxis and testing procedures are institutionalized. Without more intensive efforts, the transmission of hepatitis B from infected mothers to newborns will continue.

The full 2003 perinatal report can be found on-line at www.immunizenc.com. For more information on hepatitis B prevention in North Carolina, contact Patricia Poole, R.N., hepatitis B coordinator, at (919) 715-6777. ♦

Employee Recognition: Employee of the Quarter

*Prepared by Patsy West, Administrative Assistant,
Epidemiology Section*



Linda Carter has received the Epidemiology Section's Employee Recognition Award for the fourth quarter of 2003. Ms. Carter was nominated in the category of Leadership.

Ms. Carter has many years of experience in public health and medical care services, specializing in minority health issues, administration, management, training and assessments on multiple health and educational issues. On January 15, 2003, Ms. Carter joined the HIV/STD Prevention and Care Branch as Supervisor of the Prevention and Community Planning Unit.

Ms. Carter's leadership has been instrumental in the enhancement of the services provided by the Prevention and Community Planning Unit. Over the past year, Linda has been a driving force in the revitalization of the Regional Community Planning Groups for HIV Prevention in the three non-functional areas; the implementation of an effective monitoring process for funded Community-Based Organizations; planning of the 2003 Faith Conference in which clergy of all denominations came together to discuss health disparities among minorities in North Carolina; submission of the Prevention and Community Planning Unit's Cooperative Agreement to the Center for Disease Control one week ahead of schedule, and designing and putting into effect a new competitive HIV prevention grant application process for North Carolina Community Based Organizations which, better reflects the need for science-based intervention and accountability.

The HIV/STD Prevention and Care Branch is very fortunate to have Ms. Carter, who is passionate about HIV/STD issues and who is making a difference in North Carolina.

In addition to receiving the Epidemiology Section's Employee Recognition Award, she will be presented with a gift certificate to a local restaurant from the Epidemiology Section Management Team. ♦

State of North Carolina • Michael F. Easley, Governor
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Epidemiology Section • www.epi.state.nc.us/epi/

Dr. J. Steven Cline, Epidemiology Section Chief
Managing Editor, J. Steven Cline
Layout and Typesetting, Angela Green

Epidemiology Section Office (919) 733-3421
General Communicable Disease Control Branch (919) 733-3419
HIV/STD Prevention and Care Branch (919) 733-7301
Occupational and Environmental Epidemiology Branch (919) 733-3410
State Laboratory of Public Health (919) 733-7834
Rabies Emergency Number - Nights, Weekends, Holidays (919) 733-3419
EMERGENCY NUMBER - Nights, Weekends, Holidays (919) 733-3419

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